

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ SE

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:

The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only		
Identification of IPEA		Date of receipt of DEMAND
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		Applicant's or agent's file reference VAL 231 PCT
International application No. PCT/FI00/00438	International filing date (day/month/year) 15 May 2000 (15.05.2000)	(Earliest) Priority date (day/month/year) 14 May 1999 (14.05.1999)
Title of invention Method and arrangement for producing calendered paper or board		
Box No. II APPLICANT(S)		
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) VALMET CORPORATION Fabianinkatu 9 A FIN-00130 Helsinki Finland		Telephone No.:
		Facsimile No.:
		Teleprinter No.:
State (that is, country) of nationality: Finland		State (that is, country) of residence: Finland
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) KOIVUKUNNAS, Pekka Tupalantie 13 D 31 FIN-04400 Järvenpää Finland		
State (that is, country) of nationality: Finland		State (that is, country) of residence: Finland
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) LARES, Matti Palkkatilankatu 5 B 20 FIN-00240 Helsinki Finland		
State (that is, country) of nationality: Finland		State (that is, country) of residence: Finland
<input checked="" type="checkbox"/> Further applicants are indicated on a continuation sheet.		

Continuation of Box No. II APPLICANT(S)

If none of the following sub-boxes is used, this sheet should not be included in the demand.

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

LEINO, Mika
Kartanontie 7 A 10
FIN-04400 Järvenpää
Finland

State (that is, country) of nationality:

Finland

State (that is, country) of residence:

Finland

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

State (that is, country) of nationality:

State (that is, country) of residence:

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

State (that is, country) of nationality:

State (that is, country) of residence:

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

State (that is, country) of nationality:

State (that is, country) of residence:

☐ Further applicants are indicated on another continuation sheet.

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCEThe following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*SEPPÖ LAINÉ OY
Itämerenkatu 3 B
FIN-00180 Helsinki
Finland

Telephone No.:

+358-9-68 59 560

Facsimile No.:

+358-9-68 59 56 10

Teleprinter No.:

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filedthe description ☐ as originally filed☐ as amended under Article 34the claims ☐ as originally filed☐ as amended under Article 19 (together with any accompanying statement)☐ as amended under Article 34the drawings ☐ as originally filed☐ as amended under Article 342. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English☒ which is the language in which the international application was filed.☐ which is the language of a translation furnished for the purposes of international search.☐ which is the language of publication of the international application.☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.**Box No. V ELECTION OF STATES**The applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes not to elect:

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|--------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | sheets |
| 6. other (<i>specify</i>) | : | sheets |

For International Preliminary Examining Authority use only

received not received

- | | |
|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> |

The demand is also accompanied by the item(s) marked below:

- | | |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet | 4. <input type="checkbox"/> statement explaining lack of signature |
| 2. <input type="checkbox"/> separate signed power of attorney | 5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form |
| 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 6. <input type="checkbox"/> other (<i>specify</i>): |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

For the Applicants

Seppo Laine Oy

Simo Hovi

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply. ☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

PCT REQUEST

VAL 231 PCT

Original (for SUBMISSION) - printed on 15.05.2000 01:17:32 PM

0	For receiving Office use only	
0-1	International Application No.	
0-2	International Filing Date	
0-3	Name of receiving Office and "PCT International Application"	
0-4	Form - PCT/RO/101 PCT Request	
0-4-1	Prepared using -	PCT-EASY Version 2.90 (updated 15.12.1999)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	National Board of Patents and Registration (Finland) (RO/FI)
0-7	Applicant's or agent's file reference	VAL 231 PCT
I	Title of invention	METHOD AND ARRANGEMENT FOR PRODUCING CALENDERED PAPER OR BOARD
II	Applicant	
II-1	This person is:	applicant only
II-2	Applicant for	all designated States except US
II-4	Name	VALMET CORPORATION
II-5	Address:	Fabianinkatu 9 A FIN-00130 Helsinki Finland
II-6	State of nationality	FI
II-7	State of residence	FI
II-8	Telephone No.	+358-020 484 100
II-9	Facsimile No.	+358-020 484 101
III-1	Applicant and/or inventor	
III-1-1	This person is:	applicant and inventor
III-1-2	Applicant for	US only
III-1-4	Name (LAST, First)	KOIVUKUNNAS, Pekka
III-1-5	Address:	Tupalantie 13 D 31 FIN-04400 Järvenpää Finland
III-1-6	State of nationality	FI
III-1-7	State of residence	FI

PCT REQUEST

VAL 231 PCT

Original (for SUBMISSION) - printed on 15.05.2000 01:17:32 PM

III-2	Applicant and/or inventor	
III-2-1	This person is:	applicant and inventor
III-2-2	Applicant for	US only
III-2-4	Name (LAST, First)	LARES, Matti
III-2-5	Address:	Palkkatilankatu 5 B 20 FIN-00240 Helsinki Finland
III-2-6	State of nationality	FI
III-2-7	State of residence	FI
III-3	Applicant and/or inventor	
III-3-1	This person is:	applicant and inventor
III-3-2	Applicant for	US only
III-3-4	Name (LAST, First)	LEINO, Mika
III-3-5	Address:	Kartanontie 7 A 10 FIN-04400 Järvenpää Finland
III-3-6	State of nationality	FI
III-3-7	State of residence	FI
IV-1	Agent or common representative; or address for correspondence	
	The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	SEPPO LAINE OY
IV-1-2	Address:	Itämerenkatu 3 B FIN-00180 Helsinki Finland
IV-1-3	Telephone No.	+358-9-68 59 560
IV-1-4	Facsimile No.	+358-9-68 595 610
IV-1-5	e-mail	seppo.laine@selpat.fi

PCT REQUEST

VAL 231 PCT

Original (for SUBMISSION) - printed on 15.05.2000 01:17:32 PM

V	Designation of States	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<p>AP: GH GM KE LS MW SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT</p> <p>EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT</p> <p>EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT</p> <p>OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT</p>
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<p>AE AG AL AM AT (patent and utility model) AU AZ BA BB BG BR BY CA CH&LI CN CR CU CZ (patent and utility model) DE (patent and utility model) DK (patent and utility model) DM DZ EE (patent and utility model) ES FI (patent and utility model) GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK (patent and utility model) SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW</p>
V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
V-6	Exclusion(s) from precautionary designations	NONE
VI-1	Priority claim of earlier national application	
VI-1-1	Filing date	14 May 1999 (14.05.1999)
VI-1-2	Number	991108
VI-1-3	Country	FI

PCT REQUEST

VAL 231 PCT

Original (for SUBMISSION) - printed on 15.05.2000 01:17:32 PM

VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1	
VII-1	International Searching Authority Chosen	Swedish Patent Office (ISA/SE)	
VIII	Check list	number of sheets	electronic file(s) attached
VIII-1	Request	4	-
VIII-2	Description	13	-
VIII-3	Claims	6	-
VIII-4	Abstract	1	val231tii.txt
VIII-5	Drawings	0	-
VIII-7	TOTAL	24	
	Accompanying items	paper document(s) attached	electronic file(s) attached
VIII-8	Fee calculation sheet	✓	-
VIII-9	Separate signed power of attorney	✓	-
VIII-16	PCT-EASY diskette	-	diskette
VIII-17	Other (specified):	Copy of official action	-
VIII-18	Figure of the drawings which should accompany the abstract		
VIII-19	Language of filing of the international application	English	
IX-1	Signature of applicant or agent		
IX-1-1	Name	SEPPO LAINE OY	
IX-1-2	Name of signatory	Simo Hovi	

FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/SE
10-6	Transmittal of search copy delayed until search fee is paid	

FOR INTERNATIONAL BUREAU USE ONLY

11-1	Date of receipt of the record copy by the International Bureau	
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TENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
 US Department of Commerce
 United States Patent and Trademark
 Office, PCT
 2011 South Clark Place Room
 CP2/5C24
 Arlington, VA 22202
 ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 03 January 2001 (03.01.01)	
International application No. PCT/FI00/00438	Applicant's or agent's file reference VAL 231 PCT
International filing date (day/month/year) 15 May 2000 (15.05.00)	Priority date (day/month/year) 14 May 1999 (14.05.99)
Applicant KOIVUKUNNAS, Pekka et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

09 November 2000 (09.11.00)

☐ in a notice effecting later election filed with the International Bureau on:2. The election ☒ was☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Nestor Santesso Telephone No.: (41-22) 338.83.38
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PATENT COOPERATION TRL Y

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

SEPPO LAINE OY
Itämerenkatu 3 B
FIN-00180 Helsinki
FINLANDE

Date of mailing (day/month/year) 18 October 2001 (18.10.01)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference VAL 231 PCT	
International application No. PCT/FI00/00438	International filing date (day/month/year) 15 May 2000 (15.05.00)

1. The following indications appeared on record concerning:

☒

the applicant

☐

the inventor

☐

the agent

☐

the common representative

Name and Address

VALMET CORPORATION
Fabianinkatu 9 A
FIN-00130 Helsinki
Finland

State of Nationality

FI

State of Residence

FI

Telephone No.

+358-020 484 100

Facsimile No.

+358-020 484 101

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐

the person

☒

the name

☐

the address

☐

the nationality

☐

the residence

Name and Address

METSO PAPER, INC.
Fabianinkatu 9 A
FIN-00130 Helsinki
Finland

State of Nationality

FI

State of Residence

FI

Telephone No.

+358-020 484 100

Facsimile No.

+358-020 484 101

Teleprinter No.

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

☒

the receiving Office

☐

the International Searching Authority

☐

the International Preliminary Examining Authority

☐

the designated Offices concerned

☒

the elected Offices concerned

☐

other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

François BAECHLER

Telephone No.: (41-22) 338.83.38

TENT COOPERATION TRE Y

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

SEPPO LAINE OY
Itämerenkatu 3 B
FIN-00180 Helsinki
FINLANDE

Date of mailing (day/month/year) 26 October 2001 (26.10.01)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference VAL 231 PCT	
International application No. PCT/FI00/00438	International filing date (day/month/year) 15 May 2000 (15.05.00)

1. The following indications appeared on record concerning:		
<input checked="" type="checkbox"/> the applicant	<input checked="" type="checkbox"/> the inventor	<input type="checkbox"/> the agent <input type="checkbox"/> the common representative
Name and Address LEINO, Mika Kartanontie 7 A 10 FIN-04400 Järvenpää Finland	State of Nationality FI	State of Residence FI
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:		
<input type="checkbox"/> the person	<input type="checkbox"/> the name	<input checked="" type="checkbox"/> the address <input type="checkbox"/> the nationality <input type="checkbox"/> the residence
Name and Address LEINO, Mika Reinikaisenkatu 1 as. 1 FIN-56800 Simpele Finland	State of Nationality FI	State of Residence FI
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
3. Further observations, if necessary:		
4. A copy of this notification has been sent to:		
<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned	
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned	
<input type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:	

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Marie-José DEVILLARD
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference VAL 231 PCT	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/FI00/00438	International filing date (<i>day/month/year</i>) 15.05.2000	Priority date (<i>day/month/year</i>) 14.05.1999
International Patent Classification (IPC) or national classification and IPC ₇ D 21 G 1/00, D 21 G 9/00, D 21 F 9/00		
Applicant Valmet Corporation et al		

1.	This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2.	This REPORT consists of a total of <u>6</u> sheets, including this cover sheet.
	<input type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
	These annexes consist of a total of _____ sheets.
3.	This report contains indications relating to the following items: <ul style="list-style-type: none"> I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input checked="" type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input checked="" type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input type="checkbox"/> Certain defects in the international application VIII <input type="checkbox"/> Certain observations on the international application

Date of submission of the demand 09.11.2000	Date of completion of this report 15.08.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Telex Box 5055 17978 S-102 42 STOCKHOLM PATOREG-S Facsimile No. 08-667 72 88	Authorized officer Erika Aspeby/ELY Telephone No. 08-782 25 00

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00438

I. Basis of the report**1. With regard to the elements of the international application:***

- ☒ the international application as originally filed
- ☐ the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement) under article 19
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the drawings:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00438

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos. 3-8, 11, 12, 17, 20-25, 28, 29, 34

because:

☐ the said international application, or the said claims Nos. _____
relate to the following subject matter which does not require an international preliminary examination (*specify*):

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. _____
are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. _____ are so inadequately supported
by the description that no meaningful opinion could be formed.

☒ no international search report has been established for said claims Nos. 3-8, 11, 12, 17, 20-25, 28, 29, 34

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00438

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
- ☐ paid additional fees.
- ☐ paid additional fees under protest.
- ☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
- ☐ not complied with for the following reasons:

The independent claims 1 and 18 relate to a method and an arrangement for standardising the cross-direction thickness profile prior to long-nip calendering. The independent claims do not avoid the prior art, see document WO 9844195. The dependent claims 2 and 19 relate to standardising the thickness profile by profiled diluting in the headbox. Claims 9-10 and 26-27 relate to a different method of standardising the thickness profile. There is no technical relationship between these inventions involving one or more of the same or corresponding special technical features. However, the search examiner was able to make an international search for the inventions covered by claims 9-10 and 26-27 with negligible additional work.

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☐ all parts.
- ☒ the parts relating to claims Nos. 1, 2, 9-10, 18, 19, 13-16, 26-27, 30-33

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00438

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims	<u>2, 10, 13-16, 19, 27, 30-33</u>	YES
	Claims	<u>1, 9, 18, 26</u>	NO
Inventive step (IS)	Claims	<u>10, 27</u>	YES
	Claims	<u>1, 2, 9, 13-16, 18, 19, 26, 30-33</u>	NO
Industrial applicability (IA)	Claims	<u>1, 2, 9, 10, 13-16, 18, 19, 26, 27, 30-33</u>	YES
	Claims	<u></u>	NO

2. Citations and explanations (Rule 70.7)

The following documents are cited in the International Search Report:

D1: WO 9844195
D2: EP 0826821
D3: WO 9832916
D4: WO 9534715
D5: US 5658432

D1 describes a calendering method, in which the material web is passed through the calender, in which at least one calendering nip is formed by means of two rolls provided with resilient roll coatings. Owing to the resilient nature of the coatings, the nip becomes an extended nip. Figure 4 shows a calender with two nips, the first nip being formed between heatable hard rolls (page 12, line 7-9). When a very high calendering pressure is used, the effect of the first nip is equal to a machine calender, which means that variations in thickness of the paper are calibrated efficiently (page 7, line 20-22). According to the application, a machine calender can be used for standardising the thickness profile of the web (page 10, line 20-24). Thus, the web in the method according to D1 is standardised prior to the long nip calendering. Thus, the method according to claims 1 and 9, and the arrangement according to claims 18 and 26 do not differ from D1.

.../...

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00438

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

D2 discloses a control system to set paper web quality, which system is connected to a control unit that sets the pulp flow from the stock inlet to give the required paper quality and character. Web properties, as the thickness of the web (see claim 23), are measured at several locations. In order to adjust the profile of the web, the mixture of water and pulp is diluted in a profiled way (column 3, line 32-51). It must be considered that a person skilled in the art would try to dilute the mixture of water and pulp in the method according to D1, in order to achieve a paper with uniform thickness, thus obtaining a higher quality of calendering. Thus, claims 2, 13, 14, 19, 30 and 31 are not considered to involve an inventive step.

Claims 15, 16, 32 and 33 merely concern well-known papermaking procedures.

Other documents cited are considered as background art documents.

In respect of the arguments stated above, claims 10 and 27 are novel and considered to involve an inventive step. Claims 1, 9, 18 and 26 are not novel. Claims 2, 13-16, 19 and 30-33 are novel, but are not considered to involve an inventive step. The criterion of industrial applicability is fulfilled.

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
23 November 2000 (23.11.2000)

PCT

(10) International Publication Number
WO 00/70146 A3

(51) International Patent Classification⁷: D21G 1/00, 9/00, D21F 9/00

(21) International Application Number: PCT/FI00/00438

(22) International Filing Date: 15 May 2000 (15.05.2000)

(25) Filing Language: English

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(30) Priority Data:
991108 14 May 1999 (14.05.1999) FI

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(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— With international search report.

(88) Date of publication of the international search report:
22 February 2001

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: STANDARDIZING THE CROSS-DIRECTION THICKNESS PROFILE PRIOR TO LONG-NIP CALENDERING

(57) Abstract: A method and an arrangement for manufacturing calendered paper or board particularly in the on-line manufacturing method. In the method, a base web is formed from a mixture of water and pulp supplied from the headbox and the web is dried by removing water over the press section and over the dryer section by heating. The formed web is calendered at least once to modify the surface on at least one of its sides. Before calendering the cross-direction thickness profile of the web is standardized and calendering is carried out by means of a long-nip calender, whereby good surface quality is obtained without losing the bulk or stiffness of the web.

WO 00/70146 A3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00438

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21G 1/00, D21G 9/00, D21F 9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: D21G, D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9844195 A1 (VALMET CORPORATION), 8 October 1998 (08.10.98), page 1, line 6 - line 11; page 7, line 20 - line 22; page 11, line 24 - line 28, page 12, line 7 - line 9; figure 4 --	1,2,9,10, 13-16,18,19, 26,27,30-33
X	EP 0826821 A2 (VOITH SULZER PAPIERMASCHINEN GESELLSCHAFT MBH), 4 March 1998 (04.03.98), figures, claims --	1,2,13,14, 18,19,30,31
A	WO 9832916 A1 (VALMET CORPORATION), 30 July 1998 (30.07.98), page 2, line 16 - page 3, line 2; page 7, line 30 - page 8, line 14, claims 1,2, abstract --	1,2,13,14, 18,19,30,31

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

8 November 2000

Date of mailing of the international search report

10 -11- 2000

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00438

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9534715 A1 (ALBANY NORDISKAFILT AB), 21 December 1995 (21.12.95), page 2, line 5 - line 25 --	1,2,13-16, 18,19,30-33
A	US 5658432 A (EDWIN MICHAEL HEAVEN ET AL), 19 August 1997 (19.08.97) -- -----	1,2,13-16, 18,19,30-33

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI00/00438

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: **17 and 34**
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

See extra sheet.

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See extra sheet.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: **See extra sheet.**

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI00/00438Cont. of Box I, 2.

Present claims 17 and 34 relate to a large number of possible methods or arrangements. In fact, the claim contains so many options that a lack of clarity and conciseness within the meaning of Article 6 PCT arises to such an extent as to render a meaningful search of the claims 17 and 34 impossible.

Cont. of Box II, 4.

I: 1,2,18,19,13-16,30-33

Cont. of Box II:

- A-I. The independent claims 1 and 18 relate to a method and an arrangement for standardizing the cross-direction thickness profile prior to long-nip calendering. The dependent claims 2 and 19 relate to standardizing the thickness profile, the caliper, by profiled diluting in the headbox.
- B-II. Claims 3 and 20 relate to standardizing the thickness profile by steaming during pressing.
- C-III. Claims 4 and 21 relate to standardizing the thickness profile by pressing the web.
- D-IV. Claims 5 and 22 relate to standardizing the thickness profile by heating the web.
- E-V. Claims 6 and 23 relate to standardizing the thickness profile by cooling the web.
- F-VI. Claims 7-8 and 24-25 relate to standardizing the thickness profile by wetting the web.
- G-VII. Claims 9-10 and 26-27 relate to standardizing the thickness profile by machine calendering prior to calendering.
- H-VIII. Claims 11-12 and 28-29 relate to precalendering followed by coating and further calendering with a long-nip calender.
- IX. Claims 13-14 and 30-31 relate to measuring the thickness profile.
- X. Claims 15 and 32 relate to the web being taken directly to the long-nip calender.
- XI. Claims 16 and 33 relate to winding of the web before calendering.

.../...

INTERNATIONAL SEARCH REPORT

International application No.
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The independent claims do not avoid the prior art, see document WO 9844195 in the partial international search, form PCT/ISA/206. The special technical feature of Group II is to standardize through steaming during pressing. The special technical feature of Group III is to standardize through pressing the web. The special technical feature of Group IV is to standardize through heating the web. The special technical feature of Group V is to standardize through cooling the web. The special technical feature of Group VI is to standardize through wetting the web. The special technical feature of Group VII is to standardize through machine calender prior to calendaring. The special technical feature of Group VIII involves precalandering, coating, and finally calendaring the web with a long-nip calender. The special technical feature of Group IX is to measure the thickness profile. The special technical feature of Group X is to directly taking the web to the long-nip calender. The special technical feature of Group XI is to wind the web onto a storage roll prior to long-nip calendaring. There is no technical relationship left over the prior art among the claimed inventions that involves a corresponding special technical feature and the dependent claims mentioned in Groups II-XI are therefore left without a single general inventive concept. The lack of unity of invention is thus found "a posteriori" and the group of inventions is not so linked as to form a single inventive concept under PCT Rule 13.

However, the Groups IX-XI include such features over the prior art that is clearly obvious to a person skilled in the art and the search examiner has therefore been able to make a complete international search for the inventions covered by the Groups IX-XI with negligible additional work.

INTERNATIONAL SEARCH REPORT

Information on patent family members

03/10/00

International application No.

PCT/FI 00/00438

WO	9844195	A1	08/10/98	AU	6503698 A	22/10/98
				EP	0973971 A	26/01/00
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				FI	970294 D,V	16/06/97

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				EP	0767851 A,B	16/04/97
				ES	2135746 T	01/11/99
				FI	964973 A	12/12/96
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				NO	308319 B	28/08/00
				NO	965266 A	16/12/96
				NZ	288369 A	19/12/97
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				SE	9402094 A	16/12/95
				US	5836242 A	17/11/98
				ZA	9504985 A	14/02/96

US	5658432	A	19/08/97	NONE
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : D21G	A2	(11) International Publication Number: WO 00/70146 (43) International Publication Date: 23 November 2000 (23.11.00)
(21) International Application Number: PCT/FI00/00438 (22) International Filing Date: 15 May 2000 (15.05.00) (30) Priority Data: 991108 14 May 1999 (14.05.99) FI (71) Applicant (for all designated States except US): VALMET CORPORATION [FI/FI]; Fabianinkatu 9 A, FIN-00130 Helsinki (FI). (72) Inventors; and (75) Inventors/Applicants (for US only): KOIVUKUNNAS, Pekka [FI/FI]; Tupalantie 13 D 31, FIN-04400 Järvenpää (FI). LARES, Matti [FI/FI]; Palkkatilankatu 5 B 20, FIN-00240 Helsinki (FI). LEINO, Mika [FI/FI]; Kartanontie 7 A 10, FIN-04400 Järvenpää (FI). (74) Agent: SEPPO LAINE OY; Itämerenkatu 3 B, FIN-00180 Helsinki (FI).		(81) Designated States: AE, AG, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), DM, DZ, EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>Without international search report and to be republished upon receipt of that report.</i>
(54) Title: METHOD AND ARRANGEMENT FOR PRODUCING CALENDERED PAPER OR BOARD		
(57) Abstract <p>A method and an arrangement for manufacturing calendered paper or board particularly in the on-line manufacturing method. In the method, a base web is formed from a mixture of water and pulp supplied from the headbox and the web is dried by removing water over the press section and over the dryer section by heating. The formed web is calendered at least once to modify the surface on at least one of its sides. Before calendering the cross-direction thickness profile of the web is standardized and calendering is carried out by means of a long-nip calender, whereby good surface quality is obtained without losing the bulk or stiffness of the web.</p>		

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Method and arrangement for producing calendered paper or board

The present invention concerns a method according to the preamble of claim 1 for producing paper or board in a system where the manufactured base web is treated by means of at least one calender for improving its surface properties.

According to a preferred embodiment of the invention at least one calendering step is carried out immediately after the manufacture of the base web without any intermediate reeling, i.e., on-line calendering is used.

The invention also concerns an arrangement for implementing the method.

The invention particularly concerns the manufacture of paper or board by using on-line calendering. In on-line calendering, the calender is arranged immediately after the paper or board machine or a coating line and the web is taken directly to the calender without any intermediate reeling. Conventionally, machine calenders where the web travels between two hard rolls have been used as on-line calenders. Today, softcalenders are becoming more and more common because of the better surface gloss they achieve. Striving for improved surface gloss and smoothness has further prompted the development of multi-nip calenders suited for on-line calendering. The maximum production speed of the supercalenders used previously has been insufficient, preventing their use in connection with fast production lines.

The purpose of calendering is to increase smoothness and gloss and to improve other properties of the printing surface of paper or board. The improved properties upgrade the quality of the final printed surface. The quality and printability of the

printed surface are among the most important quality factors appreciated by paper users. Similarly, the printability of printing board and the quality of the printed surface thereof are important and, in addition, high stiffness and good bulk are often appreciated. Furthermore, a factor affecting product quality is the evenness of the cross direction profile of the web, i.e., any variations in web thickness should be as small as possible in the cross-machine direction.

Surface smoothness of the product is achieved by exposing the fibre structure of the product to high pressure and temperature by heating the hard calender rolls and by pressing the rolls against one another such that a high nip pressure is obtained in the nip between the rolls. Due to these forces the fibres forming the web reach their glass transition temperature, and the deformation caused by the nip load is permanent. The gliding of the web surface against the roll surfaces may also give rise to alterations in fibre shape, thus enhancing the smoothing effect.

When multi-nip calendering has been used , the paper has usually been manufactured on a paper machine and thereafter coated, if desired. In both cases the coated or uncoated paper has been reeled onto storage rolls and calendered by means of separate calenders. The paper has been dried to a very low moisture content, typically about 1 to 3 % of its total weight. Prior to calendering the paper is sufficiently wetted in order to obtain good calendering results. A suitable moisture content for multi-nip calendering is approximately 6 to 10 %. The purpose of drying to a low moisture content is to achieve an even cross direction moisture content profile. The short storage time prior to the calendering step also evens out the moisture content profile. In present on-line calendering processes the web is dried to a high degree of dryness whereafter it is rewetted before calendering, and thus, the

process is similar to off-line calendering.

The web can be wetted e.g. by means of the water jet damping device described in US publication No. 5,286,348, which achieves an even moisture content profile in the cross-machine direction of the web.

The above-described method which comprises first drying and then rewetting the web is hampered by the time required by the absorption and evening out of the moisture, particularly in the thickness direction of the web and at the surface. If the wetting is performed immediately before calendering, the uneven moisture content profile will affect the final surface properties and the quality grade of the paper may be impaired.

Drying and rewetting increase the energy consumption during the manufacture of the product as well as the space required by the equipment when compared to a process which does not require overdrying and rewetting prior to the calendering step. An uneven moisture content, e.g. surface moisture or an uneven moisture profile in some web direction leads to changes in the properties of the web, such as gloss or thickness profile because moisture has a strong impact on the workability of the fibres. In the case of an uneven thickness profile, problems will occur in winding, which may even cause cross-direction wrinkles in customer rolls because even tightness is not achieved. The wrinkles will reduce the runnability of the product in further processing e.g. during printing in other further processing machines, thus impairing the quality of the product from the customer's point of view.

Moisture profile affects many factors in the manufacture of paper or board as well as in the final quality of the product. One factor worth noticing is that if fluctuations occur in moisture content, drier parts of the web will start to shrink

before the wetter parts, which in turn will lead to stretching of the wetter parts. Uneven stretching will then lead to uneven drying shrink, which in turn leads to thickness variations and variations also in other properties of the product.

In modern machines, the moisture content of the paper or board web to be manufactured is controlled in many ways particularly at the beginning of web formation. The most important target of controlling moisture content profile is good runnability of the machine and the product being manufactured, i.e. maximal production output within a given duration is striven for. This is understandable because moisture content profile and tension profile are highly interdependent. Thus, the best possible moisture content profile has been striven for in such parts of the machine where the effect of dampness profile control on runnability is at its greatest. The dampness profile of the finished base web is then not necessarily homogeneous and it is subject to tension. If the web is stored prior to calendering, the dampness will be evened out and the tensions will be relaxed, and thus, the evenness of the final dampness of the web is of less importance. If, however, on-line calendering is used, the homogeneity of the final dampness has a strong effect on product quality and if the web moisture content is controlled by present methods and principles, the properties of calendered paper or board may even suffer, and the desired improvement in the properties of the final product is not achieved. In multi-nip calenders, it is possible to exercise a relatively strong influence on the thickness profile of the web, but in these calenders a very high nip pressure is applied, wherefore the calendering will usually lead to a significant reduction in thickness and bulk when compared to other calender types. Thus, multi-nip calendering is normally used in the manufacture of products of which a high degree of smoothness and particularly gloss is expected.

One very important feature in the calendering process is that calendering is applied to obtain a slick and smooth surface without losing any more stiffness or bulk than is necessary. As the surface of paper or board is subjected to even very high pressure during calendering depending on calender type, the web is compressed, whereby its thickness is reduced and the web is compacted, in other words its mass per volume is increased, i.e. its bulk is reduced. A reduced thickness and bulk of the web will naturally also result in reduced stiffness. As maximal stiffness and light weight per volume unit is normally required of the product being manufactured, it is difficult to match the different effects of calendering with the properties of the end product.

On the other hand, calendering is used to standardize the thickness profile of the paper, i.e. to remedy thickness defects which may have occurred during web formation. The harder the surface of the rolls used, the easier it is to amend the profile, and thus a machine calender will usually obtain the best profile amendment results, and consequently, this is the most important field of use for this type of calenders. Today, a machine calender is used in many paper machines to finish the thickness profile and surface quality of paper such that they meet the requirements set for the final product. This has been so because there are only limited ways of controlling the cross-direction thickness profile on a paper or board machine, and an acceptable thickness profile cannot be achieved without machine calendering. By means of machine calendering it is possible to raise the surface quality of the product such that it meets end users' demands, but the properties of machine calenders are limited when it comes to improving surface quality, wherefore no remarkable improvement in smoothness or gloss can be obtained by means of a machine calender. As the quality requirements set for printing surfaces are constantly on the increase, other calendering methods must more and more

often be used in addition to or instead of machine calendering.

Other types of calenders, such as soft-, long-nip or multi-nip calenders, will obtain a considerably improved surface quality, but they have a much weaker thickness profiling capability than machine calenders, mainly due to the softness of the surfaces on the parts which press the web. It is known that with a reduced tensile stiffness of the calender roll coating, the thickness profiling capability of the calender is impaired but its ability to produce a product with good printing properties is improved. As a machine calender has rolls of cast iron or steel, they may have very hard surfaces, resulting in good thickness standardization. On the other hand, the hard surface will exert stronger pressure on the web at its thicker and denser (harder) parts, wherefore the smoothing effect exerted on the web concerns the thicker parts of the web, and thus, surface properties will vary in different parts of the web.

The present invention aims at providing a method for manufacturing calendered paper or board, enabling the manufacture of a product having a uniform thickness profile, whereby the bulk of the web is reduced as little as possible, yet achieving good quality of the printing surface.

The invention is based on standardizing the cross-direction thickness profile of the base web prior to final calendering and performing the final calendering on a long-nip calender, for example a shoe calender.

In more detail, the method according to the invention is characterized by what is stated in the characterizing part of claim 1.

The arrangement according to the invention, then, is characterized by what is stated in the characterizing part of

claim 18.

The invention achieves considerable benefits.

The invention allows considerable savings in the pulp of the base web, because the bulk of the web is better by as much as 5 to 10 % after calendering than that of a product manufactured using conventional calendering methods. This is of considerable advantage for the paper or board manufacturer because the grammage of the product can be reduced without compromising its thickness and particularly its stiffness. Thus, it is possible for the manufacturer to have a smaller grammage and pulp consumption and to still produce paper or board having unaltered stiffness. The surface and printability properties of the product are good, as is its thickness profile. The good thickness profile results in good customer rolls of even tightness in the longitudinal direction of the roll, whereby wrinkle formation is reduced. Rolls of uniform tightness and precisely cylindrical shape are easy to handle at the plant and particularly during further processing, and the rolls have good runnability properties in further processing machines such as printing machines.

The product surface has homogeneous properties over the entire surface, and alterations in surface quality occurring due to machine calendering are avoided. The method according to the invention is well suited for raising the product quality of paper and board machines already in production e.g. in connection with modernizations. The invention is applicable to off-line calendering but is of particular advantage in on-line systems where the optimization of the manufacture of the base web is more easily combined with the optimization of the calendering event.

The present solution is applicable to the manufacture of both

uncoated and coated products. In the manufacture of coated paper or board grades the coating step is carried out prior to the final calendering step, whereby a long-nip calender will obtain a very even and smooth surface and any unevenness of the base web will not show during visual inspection of the web, because the soft belt of a long-nip calender does not highlight unevenness as does e.g. the slightly harder roll coating of a softcalender.

In the following, the invention is examined in more detail with the help of a number of working examples and alternative embodiments.

In the following, the term long-nip calender is used to refer to a calender having a nip length of over 30 mm, typically 50 to 280 mm.

The purpose of calendering is to produce a good surface for paper or board of which a good printing surface is required. It is of importance in the manufacture of both paper and especially board that the stiffness of the product is reduced as little as possible. Often sufficient stiffness is of importance for the handling of the paper and in the case of printable packing boards, among others, the material must be of sufficient stiffness to enable the manufacture of strong packages. Previously known calendering methods provide reduced thickness and stiffness of the product, but the most modern long-nip calenders obtain good surface quality with only small losses in stiffness or bulk. In the case of a long-nip calender, a good surface is provided by means of a soft calendering surface, a relatively low surface pressure and a high thermoroll temperature. In a long-nip calender the calendering surface usually comprises a belt which is used to press the web against a heated thermoroll. A roll can be used for pressing the belt, whereby the length of the nip is

limited, or a shoe can be used whereby considerable pressing distances are achieved. Another advantage of the shoe calender is that the length of the nip is adjustable as well as the cross-direction nip pressure distribution. The adjustment possibilities available are naturally dependent on the structure of the calender.

Another important purpose of a calender is to amend the thickness profile of the product. As stated above, the thickness profile can be affected the better, the harder the calendaring surface used. Thus, a long-nip calender allows much less acting on the thickness profile than other calenders because the hardness of the calendaring belt or other means used is low when compared to the hardness of the rolls and roll coatings of other calender types. Thus, a long-nip calender does not allow any significant influence to be exerted on the thickness profile even when a zone-adjusted shoe calender is used.

On a paper or board machine the web is formed by feeding water and pulp from a headbox onto a wire or between two wires. The web having a high moisture content is dried by removing water by pressing the web over the press section and by heating it over the drying section by means of a drying cylinder, among others.

Today a number of devices are known which can be used to affect the thickness profile of the base web already during the formation step of the web, and consequently, web thickness can be standardized even before it enters the calender. Thus a long-nip calender may be used if the thickness profile of the web is standardized prior to calendaring. The thickness profile of the base web can be affected in many ways during the formation and drying of the entire web. The first possibility to affect the web profile is in the headbox where the web is

formed. In the headbox the fibre content of the pulp to be fed onto a former wire or into a twin wire can be adjusted e.g. by means of dilution adjustment by adding water into the pulp or, on the other hand, in the cross direction more pulp may be fed to certain parts of the wire where needed. In the press section of the machine, profiling steaming or compression may be applied, and in the drying section, profiling drying or wetting. Actuators affecting the profile include e.g. a dilution-adjusted headbox, a zone-adjusted press roll arranged in the press section or a belt-supported zone-adjusted press roll, a profiling steam box or wetter or a profiling web heater or cooler, e.g. a roll that is cooled zone by zone. Where a film transfer coater can be arranged prior to the calender, the profiling can be carried out by using the coater to apply water or an adhesive mixture onto the web surface. Instead of a film transfer coater, e.g. a spray coater can be used which has a simple construction and can be fitted even into a small space. The thickness profile of a web that has been dried to almost its final dryness can be further adjusted by profiling wetting or a hard calender nip. If e.g. a machine calender is used for standardizing the thickness profile of the web, it is of importance in the solution according to the invention that the nip load be kept small so as not to lose web thickness, bulk or stiffness during calendering. What is essential in the preferred embodiment of the invention is the optimization of the thickness profile adjustment of a paper or board machine for calendering.

The effect of the moisture content profile of the web and differences in moisture content has been discussed in the Applicants' parallel PCT Application No. FI98/00895, wherefore it may suffice in the present context to say that altering the moisture content profile of the web can be used to essentially affect the thickness profile. Said application is enclosed herein as reference.

According to the invention the thickness profile of the base web is standardized prior to calendering and the calendering step is carried out on a long-nip calender, preferably e.g. a shoe calender. As a shoe calender can no longer be used to essentially affect the thickness profile of the base web, the web must be of sufficiently homogeneous thickness already before calendering. The thickness profile can be standardized using the above-mentioned equipment. In order to be able to implement the method it must be ensured that the thickness of the base web has been standardized before the web enters the calender. For this reason, profile measurement is needed before the calender. Profile measurement can be carried out at any stage before calendering but as the thickness profile may be altered over the press section or during drying, there is cause to perform at least one measurement as close to the calender as possible, preferably immediately before calendering. Thickness profile measurement can be carried out prior to the last actuator which can be used to affect the thickness profile, whereby it is still possible to fix any possible profile defects by means of said actuator. The minimum requirement is that the profile be measured at least at one point prior to calendering and advantageously at least at one point prior to the last profiling instrument and immediately before the calender to ensure the fixing of any profile defect. After the calender a final quality assurance measurement can be carried out.

One advantageous way of standardizing the web thickness profile is to use a machine calender equipped with hard rolls which is run at a low nip pressure. In this case the nip pressure of the machine calender must be kept extremely low and the aim is not to use it to affect the microroughness of the surface. A machine calender can, however, be used to even at low nip pressures effectively even out the thickness profile,

simultaneously smoothing out the macroroughness of the surface, i.e. variations in the shape of the surface that are clearly greater than the fibre thickness. The method is particularly well suited for the manufacture of coated grades of board or paper, whereby machine calendering is carried out prior to the first coating step and long-nip calendering after coating. In the following an example of such a method is described. The method is particularly well suited for the manufacture of liquid packaging board.

Conventionally, liquid packaging boards are coated twice because unbleached pulp is used for the core and bottom layers thereof, whereby a large amount of coating mix is required to obtain a surface of sufficient brightness. As coating method, blade coating is most commonly used, but even air brush coating is used because of its good opacity. Blade coating provides poor opacity and the air brush has poor runnability and limited speed. In addition, background wetting is required in order to control warp.

According to the invention the board is first calendered by means of a machine calender or a softcalender using low nip pressure which is usually below 50 MPa, the nip length being less than 50, typically 1 to 30 mm, and the surface temperature of the thermoroll being 80 to 300 °C. When a softcalender is used, the coating has a hardness of 80 to 95 ShA. The purpose of precalendering is to alter the thickness profile and surface roughness of the board such that they are at the level required by the following treatment steps without significantly reducing the bulk and stiffness of the board. Due to this requirement the board is not calendered to have a fully smooth surface topography, instead, its Bendtsen roughness number may remain at a level below 700, typically 500 to 600 ml/min. The precalendering step can be enhanced by steaming or wetting with water.

After precalendering precoating is carried out preferably by means of a film transfer coater, whereby an opaque coat which well follows the surface contour is obtained. A film transfer coater can be used to simultaneously perform background wetting with water or a starch solution, wherefore separate background wetting is not required. The susceptibility to breaks of a film transfer coater is also considerably lower than that of blade coaters. The front coat is provided at a rod or blade coating head where jet application is used for applying the coating mix. The pressure impulse of a jet applicator is small wherefore the coat does not penetrate into the web but instead provides good opacity on the web surface. A long dwell distance is used between application and doctoring, whereby a set immobilization layer has time to form on the web surface whose dry matter content has risen. In this manner, a greater amount of coating mix and better opacity are achieved. A blade doctor achieves excellent smoothness of the end product, but a rod doctor may also be used.

The final calendering is carried out on a long-nip calender having a typical nip pressure of 1 to 12 MPa, a nip length of 30 to 280 mm and a thermoroll temperature of 100 to 300 °C. The belt hardness of a long-nip calender is typically 80 to 100 ShA. The advantage provided by a long-nip calender lies in the excellent surface smoothness and glare achieved without reducing the stiffness and bulk of the product, as well as a visually very even surface. When a long-nip calender is used, any unevenness in the surface of the base web will not emerge during visual inspection due to the soft calendering belt and low nip pressure.

The method of the invention is especially suited for on-line arrangements but can also be used in off-line manufacturing systems where intermediate reeling is applied.

Claims:

1. A method for producing calendered paper or board, comprising

- forming a base web from the mixture of water and pulp supplied from the headbox and drying the web by pressing and heating, and
- calendering the web at least once for modifying its surface at least on one side,

characterized by

- standardizing the cross-direction thickness profile of the web prior to the calendering step, and
- calendering the web by means of at least one long-nip calender.

2. The method of claim 1, **characterized** by standardizing the thickness profile of the web by diluting in a profiled manner the mixture of water and pulp supplied from the headbox.

3. The method of claim 1, **characterized** by standardizing the thickness profile of the web by steaming the web in a profiled manner during pressing.

4. The method of claim 1, **characterized** by standardizing the thickness profile of the web by pressing the web in a profiled manner.

5. The method of claim 1, **characterized** by standardizing the thickness profile of the web by heating it in a profiled manner.

6. The method of claim 1, **characterized** by standardizing the thickness profile of the web by cooling the web in a profiled manner.

7. The method of claim 1, **characterized** by standardizing the thickness profile of the web by wetting it in a profiled manner.

8. The method of claim 7, **characterized** by standardizing the thickness profile of the web by wetting the web in a profiled manner by means of a film transfer coater or a spray coater.

9. The method of claim 1, **characterized** by standardizing the thickness profile of the web by treating the web by means of a machine calender prior to the final calendering step.

10. The method of claim 9, **characterized** by standardizing the thickness profile of the web by treating the web by means of a zone-adjusted machine calender prior to the final calendering step.

11. The method of claim 1, 9 or 10, **characterized** by precalendering the web, coating the web with at least coating layer and calendering the web at least once by means of a long-nip calender.

12. The method of claim 11, **characterized** by using a precalender having a nip length of less than 50 mm, a nip pressure of 50 MPa at the most, and a thermoroll temperature of 80 to 300 °C, and a long-nip calender having a nip length of 30 to 280 mm, a nip pressure of 1 to 12 MPa, a thermoroll temperature of 100 to 300 °C, and a calender belt hardness of 80 to 100 ShA.

13. The method of claim 1, **characterized** by measuring the

thickness profile of the web at least at one point over the length of the machine prior to long-nip calendering.

14. The method of claim 13, **characterized** by measuring the thickness profile at least immediately before long-nip calendering and preferably at least at one point before the last actuator acting on the thickness profile.

15. The method of claim 1, **characterized** by taking the web to the long-nip calender directly from the paper or board machine.

16. The method of claim 1, **characterized** by winding the web onto a storage roll prior to long-nip calendering.

17. The method of claim 1, **characterized** by standardizing the thickness profile of the web by using at least two of the following methods, headbox dilution adjustment, profiling steaming over the press section, profiling press, profiling drying, profiling cooling, profiling wetting, machine calendering, and profiling machine calendering.

18. An arrangement for manufacturing calendered paper or board, comprising

- a headbox for forming a base web from a mixture of water and pulp fed from the headbox,
- means for removing water from the web by pressing,
- means for drying the web by heating, and
- at least one calender for modifying at least one side of the web,

characterized by

- means arranged before the calender in the travel direction of the web for standardizing the cross-direction thickness profile of the web before calendering, and
- at least one long-nip calender for treating the web having a standardized thickness profile.

19. The arrangement of claim 18, **characterized** by a dilution-adjusted headbox.

20. The arrangement of claim 18, **characterized** by means for profiled steaming of the web arranged in connection with the means for removing water from the web by pressing.

21. The arrangement of claim 18, **characterized** by adjustable means for standardizing the thickness profile of the web for standardizing the thickness profile of the web by pressing the web in a profiled manner in connection with the removal of water.

22. The arrangement of claim 18, **characterized** by means for standardizing the thickness profile of the web by drying it by heating in a profiled manner.

23. The arrangement of claim 18, **characterized** by means for standardizing the thickness profile of the web by cooling the web in a profiled manner.

24. The arrangement of claim 18, **characterized** by means for wetting the web in a profiled manner.

25. The arrangement of claim 24, **characterized** by a film transfer coater or a spray coater arranged before the long-nip calender for profiled wetting of the web.

26. The arrangement of claim 18, **characterized** by a machine calender for treating the web prior to the final calendering step.

27. The arrangement of claim 26, **characterized** by a zone-adjusted machine calender for treating the web prior to the final calendering step.

28. The arrangement of claim 18, 26 or 27, **characterized** by at least one precalender, at least one coater for coating the web with at least one coating layer, and at least one long-nip calender.

29. The arrangement of claim 28, **characterized** in that the precalender has a nip length of below 50 mm, a nip pressure of 40 MPa at the most, and a thermoroll temperature from 80 to 300 °C, and the long-nip calender has a nip length of 30 to 280 mm, a nip pressure of 1 to 12 MPa and a thermoroll temperature of 100 to 300 °C, as well as a calender belt hardness of 80 to 100 ShA.

30. The arrangement of claim 18, **characterized** by means for measuring the thickness profile of the web at least at one point before long-nip calendering over the length of the machine.

31. The arrangement of claim 30, **characterized** by means for measuring the thickness profile at least immediately before long-nip calendering and preferably at least at one point before the last actuator acting on the thickness profile.

32. The arrangement of claim 18, **characterized** in that the long-nip calender is arranged directly after the paper or board machine.

33. The arrangement of claim 18, **characterized** by a reeler for reeling up the web onto a storage roll before long-nip calendering.

34. The arrangement of claim 18, **characterized** by at least two devices included in the following group: dilution-adjusted headbox, profiling steamer over the press section, profiling press, profiling dryer, profiling cooler, profiling wetter, machine calender and profiling machine calender.